Contribution ID: **27** Type: **not specified**

Tackling critical slowing down using global correction steps with equivariant flows within the 2D Schwinger model

Tuesday 16 August 2022 14:30 (40 minutes)

Discretisation of gauge theories are an elegant and successful way to solve them via supercomputers. To obtain results at the continuum, the discretised model is simulated via Monte Carlo simulations at fixed physics at different lattice spacings and then extrapolated to the continuum. In many cases the major systematic effect of the obtained result is given by the extrapolation error. To minimise this error, simulations at finer lattice spacing are necessary, which are often prevented by increasing autocorrelation times, caused by a freezing of extensive quantities, such as the topological charge.

We will discuss a potential method to overcome topological freezing in gauge models with fermions. The method combines flow-based generative models for local gauge field updates and hierarchical updates of the factorised fermion determinant. The flow-based generative models are restricted to proposing updates to gauge-fields within subdomains, thus keeping training times moderate while increasing the global volume. We apply our method to the 2-dimensional (2D) Schwinger model and show that sampling of topological sectors can be achieved also at fine lattices.
Moreover, we will discuss the potential of combining the correction steps with the Hybrid Monte Carlo method.

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Session Classification: Machine Learning